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MINISTRY OF TRANSPORT

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Danish Climate Statistics 1971-2000 to ECMWF
- for verification and development in connection
with the set-up of a
"Severe Weather Forecasting System"

Dansk klimastatistik 1971-2000 til ECMWF
- til verifikation og udvikling i forbindelse med
opbygning af et
"System til varsling af farligt vejr"

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The report (pdf-format) and the accompanying data set can be downloaded from the publication part of DMI webpages (www.dmi.dk).

Indholdsfortegnelse/Table of Contents

Introduktion

Nærværende rapport præsenterer dansk klimastatistik for perioden 1971-2000 for 8 lokaliteter jævnt fordelt ud over landet.

Klimastatistikken er udarbejdet i forbindelse med udvikling af et fremtidigt "Severe Weather Forecasting System" på "European Centre for Medium-Range Weather Forecast" (ECMWF).

Det skal bemærkes, at klimastatistikken er udarbejdet til et specielt formål og derfor afviger fra, hvad der er normal praksis på Danmarks Meteorologiske Institut (DMI).

Rapport (pdf-format) og tilhørende data kan hentes på DMI's Internetsider (www.dmi.dk) under "Publikationer".

Introduction

This report presents danish climate statistics for the period 1971-2000 for 8 stations throughout the country.

The climate statistics are processed in connection with the development of a future "Severe Weather Forecasting System" at the "European Centre for Medium-Range Weather Forecast" (ECMWF).

Please notice that the climate statistics are processed for a certain purpose and for that reason differs from the normal practice at the Danish Meteorological Institute (DMI).

The report (pdf-format) and the matching data set can be downloaded from the publication part of DMI web pages (www.dmi.dk).

Observationer og metoder

Meteorologisk døgn
Et "meteorologisk døgn" er defineret så det begynder kl. 06 UTC (GMT) om morgenen og slutter kl. 06 UTC den følgende morgen. 06 UTC er det samme som kl. 07 dansk vintertid (eller dansk normaltid) og kl. 08 dansk sommertid.

Stationerne
Rapporten præsenterer klimastatistik for én stationstype (se også kort).

Den synoptiske station observerer vejr, skydække, sigtbarhed, snedække, luft-temperatur, relativ fugtighed, vind, lufttryk og nedbør kl. 00, 03, 06, 09, 12, 15, 18 og 21 UTC eller oftere. Selvom nogle af stationer har foretaget observationer hver time er disse ikke medtaget i denne rapport. Verden over følger synoptiske stationer altid det samme måleprogram med målinger mindst hver 3. time og de følger de samme retningslinier for målingerne. De danske synoptiske stationer har i tid og rum opereret med en forskellig grad af automation og det har selvfølgelig haft en indflydelse på, hvordan parametrene nøjagtigt er obser-veret.
Stationsnummeret for synoptiske stationer i Danmark består af 5 cifre, altid begyndende med cifrene 06.

Fejlagtige og manglende data
Alle observationer, der ligger til grund for denne rapport er omhyggeligt blevet un-dersøgt og samtlige fejlagtige og mang-lende data er blevet rettet op eller fjernet, før der er beregnet statistikker.

DMI har arkiveret information om samtlige nødvendige justeringer af dataserierne.

Observations and methods

The meteorological day
The 'meteorological day' starts at 06 hours UTC (GMT) in the morning and ends at 06 hours UTC the following day. 06 hours UTC is 07 hours Danish Winter Time (or 07 hours Danish Normal time) and 08 hours Danish Summer time.

The stations
This report presents climate statistics from one type of observation station (see also the map):

The synoptical station observes weather, cloud cover, visibility, snow cover, air temperature, relative humidity, wind, air pressure and precipitation at 00:00, 03:00, 06:00, 09:00, 12:00, 15:00, 18:00 and 21:00 hours UTC or more often. Although some stations has observed every hour the clock around, they are not a part of this report. Synoptical stations all over the world follow at least the 3-hour interval around the clock, and they always follow the same guidelines. Synoptical stations in Denmark have operated with different automatisation both in time and space, which has of course affected how the parameters is observed. The station number describing synoptical stations in Denmark consist of 5 digits, always starting with the number 06.

Erroneous or missing values
All the series of original observations have been examined carefully and all erroneous or missing data have been corrected or removed before calculating the statistics.

DMI maintains information on the origin of the values in every series.

Homogenitet

Homogenitet - både i tid og rum- af observationerne er kritisk for enhver type analyse. For at en serie kan regnes for homogen, må målingerne af den pågældende klimaparameter ideelt være udført med samme type instrument og på samme måde gennem tiden. Hvad angår den rumlige homogenitet må de enkelte instrumenter på de forskellige målesteder også være kalibreret ens.

Inhomogeniteter opstår når en eller flere faktorer ændrer sig over observationsperioden. Ændringer i instrumentering, fx introduktionen af automatisk udstyr, vil ikke nødvendigvis lede til en "pludselig" inhomogenitet, men mange ændringer af denne type gør. Stationsflytninger har næsten altid en effekt og det samme gælder nogle gange observatorskift, selvfølgelig specielt når vi har med visuelle observationer at gøre. Faktorerne kan også ændre sig gradvist, fx vegetation der vokser, og i disse tilfælde kan observationerne udvise en ikke naturlig trend.

Siden 1971, har det ikke kunne undgås at ændringer af ovenstående typer i et vist omgang er indtruffet på de danske målesteder, men det har tilsyneladende ikke påvirket homogeniteten af de enkelte serier væsentligt.

For at være sikker på, at alle serier i denne rapport er så homogene som muligt, har de, udover en nøje gennemgang af de enkelte til grund liggende observationer, også undergået et grundigt visuelt check, hvor de samtidig er blevet sammenlignet med andre beslægtede parametre fra samme station.
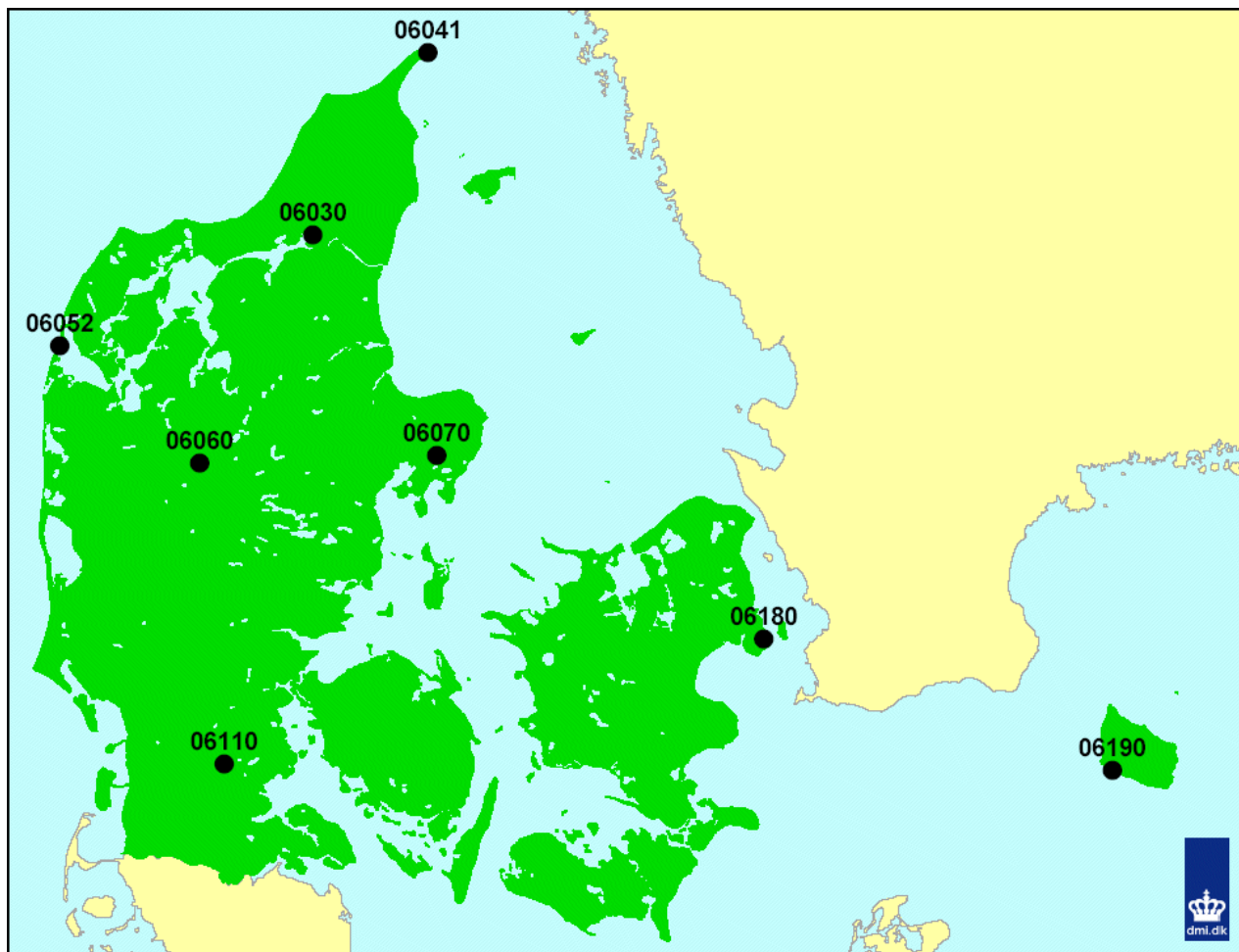
Homogeneity of the series

Temporal and spatial homogeneity of observations is critical to any kind of analysis. The homogeneity of a series requires the local measurement to have been carried out with the same type of instrument and according to instructions unchanged over time. For spatial homogeneity the individual instruments must also be calibrated in the same way as their neighbours.

Inhomogeneity occurs when one or more factors change during the observation period. Changes in the instrumentation set-up, e.g. the introduction of automatic equipment, do not necessarily lead to abrupt inhomogeneity, but many changes do. The relocation of a station nearly always have an effect. The same applies sometimes to changes in observers, especially with regard to visual (subjective) observations. When one or more factors change gradually i.e. vegetation, the series can show a non-natural trend in the observations.

Since 1971, different types of changes have occurred at the observation sites in Denmark, but apparently these changes have not affected the homogeneity of the series significantly.

To ensure an acceptable level of homogeneity, all the series - in addition to a careful examination of the original observations - have been subjected to close visual scrutiny, under which they also have been compared with the time series for related climate elements from the same stations.

Kort, der viser placeringen af de DMI vejrstationer, der har leveret data til rapportens talmateriale.

Map showing the positions of the DMI weather stations, having delivered data to the this report.

Stat_no	Station name	lat (deg.)	lon. (deg.)	elev. (m)
06030	FSN ÅLBORG	5706N	951E	3
06041	SKAGEN FYR	5744N	1038E	3
06052	THYBORØN	5642N	813E	2
06060	FSN KARUP	5618N	907E	52
06070	FSN TIRSTRUP	5618N	1037E	23
06110	FSN SKRYDSTRUP	5514N	916E	41
06180	KØBENHAVNS LUFTHAVN	5537N	1239E	5
06190	BORNHOLMS LUFTHAVN	5504N	1445E	15

Klimastatistik

Data er præsenteret i datafiler; én for hver parameter og station og der medfølger også en fil med metadata.

Datafilerne består af et generelt datahoved med oplysninger om stationsnummer og parameter. Dernæst kommer et datahoved for hver måned med månedsnummer, antal valide og manglende data samt absolut minimum og maksimum af parameteren i den pågældende måned efterfulgt af 99 percentiler (%) med tilhørende værdier (se nedenfor).

1% percentilen er den værdi, der afskærer de nederste 1% af datamaterialet, 50% percentilen er materialets median, mens 99% percentilen afskærer de øverste 1% af data.

I filen **ecmwf_06030_ttt12.txt** kan fx aflæses, at for 06030 Ålborg Lufthavn er 70% percentilen i januar måned for temperaturen kl. 12 UTC lig med 3,6ºC. Det betyder, at i januar i Ålborg optræder dage med mindre end 3,6ºC målt kl. 12 UTC præcis 70 % af tiden.

I samme fil og samme måned kan aflæses, at dage med mere end 8,7ºC kl. 12 UTC kun forekommer i et 1% af tilfældene (se 99 percentilen i januar).

Datamaterialet er baseret på perioden 1971-2000.

Climate statistics

The data are presented in data files; one for each parameter and station and additionally a file with metadata.

The data files consist of a general header with informations about station number and parameter, followed by 12 groups of monthly headers/percentiles. The monthly header consist of a minimum and maximum parameter value for the specific month followed by 99 percentiles (%) with associate values (see below).

The 1% percentile is the value, which cut off the lowest 1% of the data, the 50 % percentile is the simply the median and the 99% percentile cut off the highest 1% of the data.

As an example following can be read in the data file **ecmwf_06030_ttt12.txt**: the 70% percentile for 06030 Ålborg Lufthavn in January as regards the temperature observed 12 UTC is 3,6ºC. This means, that in January in Ålborg, days with temperature observed 12 UTC lesser than 3,6ºC, occur 70% of the time. In the same data file and in the same month the statistics also tell us that days with more than 8,7ºC observed 12 UTC only occur in 1% of the climate samples (see the 99 percentile in January).

The statistics are computed for the reference period 1971-2000.

Parameter description:

Parameter	Description
TTT00	2 metres temperature (ºC) 00 UTC
TTT12	2 metres temperature (ºC) 12 UTC
TMIN	Absolute minimum temperature (ºC) for the meteorological day[1]
TMAX	Absolute maximum temperature (ºC) for the meteorological day
FF12	10 minuttes average wind speed (m/sec) 12 UTC
MAX10MINWIND	Max. 10 min. average wind[2] (m/sec) for the meteorological day
MAXGUST	Max. wind gust[3] (m/sec) for the meteorological day
RRR24	24 hours precipitation (mm) for the meteorological day
RRR120	120 hours precipitation[4] (mm)

[1] A 'meteorological day' starts at 06 hours UTC (GMT) in the morning and ends at 06 hours UTC the following day. 06 hours UTC is 07 hours Danish Winter Time (or 07 hours Danish Normal time) and 08 hours Danish Summer time.
[2] Taken from eight 10 minuttes readings every 3 hour the clock around.
[3] Max. wind gust are taken from continuous readings, having a positive deviation equal or more than 5 m/sec from the mean wind speed. This means that days easilycan be without gust reports.
[4] Five days preciptation (120 hours) are calculated by adding 24 hours precipitation for all groups of five consecutive days for the whole period. The 120 hours precipitation have subsequently been put on the last day of the fve days period i.e. the 120 hours preciptation from day 1-5 have been put on day 5, 120 hours precipitation from day 2-6 on day 6 and vice versa.

Data file description:

General header:
1. line	Station number (I5)
2. line	Parameter (A15)

Monthly header:
3. line	Month (I2), number of valid data (I3)
4. line	Number of missing data (I3)
5. line	Absolute minimum (F6.1)
6. line	Absolute maximum (F6.1)

Percentiles:
7. line	Percentile 1 (I2), associate parameter value (F6.1)
……	
105. line	Percentile 99(I2), associate parameter value (F6.1)

Monthly header:
106. line	Month (I2), number of valid data (I3)
107. line	Number of missing data (I3)
108. line	Absolute minimum (F6.1)
109. line	Absolute maximum (F6.1)

Percentiles:
110. line	Percentile 1 (I2), associate parameter value (F6.1)
……	

Metadata

Metadata er "data om data" og filen **station.txt** beskriver stationsnummer, parameter, stationsnavn, position, højde over havet samt det første og det sidste år i den periode, der er medtaget for hver klimaparameter i denne rapport.

Hver linie i filen repræsenterer en station/en paramter. Filen er sorteret efter stationsnummer.

Metadata

Metadata are "data about data" and the file **station.txt** describes the station no., parameter, station name, position, elevation and first and last year of the climate element series in this report.

Each record in the file contains information about one station/paramter. The file is sorted by station no.

Position	Format	Description
1-6	F6.0	Station no.
7-21	A15	Parameter
22-51	A30	Station name
52-53	F2.0	Latitude (degrees)
54-55	F2.0	Latitude (minutes)
56-56	A1	Northern (N) or Southern (S) hemisphere
57-58	F2.0	Longitude (degrees)
59-60	F2.0	Longitude (minutes)
61-61	A1	East (E) or West (W) of Greenwich
62-65	F4.0	Elevation (metres above mean sea level)
66-71	F6.0	First year in the data series
72-77	F6.0	Last year in the data series

Datafiler

Datamaterialet medfølger denne rapport i 71 ASCII filer:

70 datafiler (**ecmwf_<station number>_<parameter>.txt**)
1 metadata fil (**station.txt**)

På side 8 -10 er indholdet af de enkelte filer specificeret.

Data files

Data are inclosed in this report as 71 ASCII files.

70 data files (**ecmwf_<station number>_<parameter>.txt**)
1 metadata file (**metadata.txt**)

On page 8 -10 the contents of each file are described.